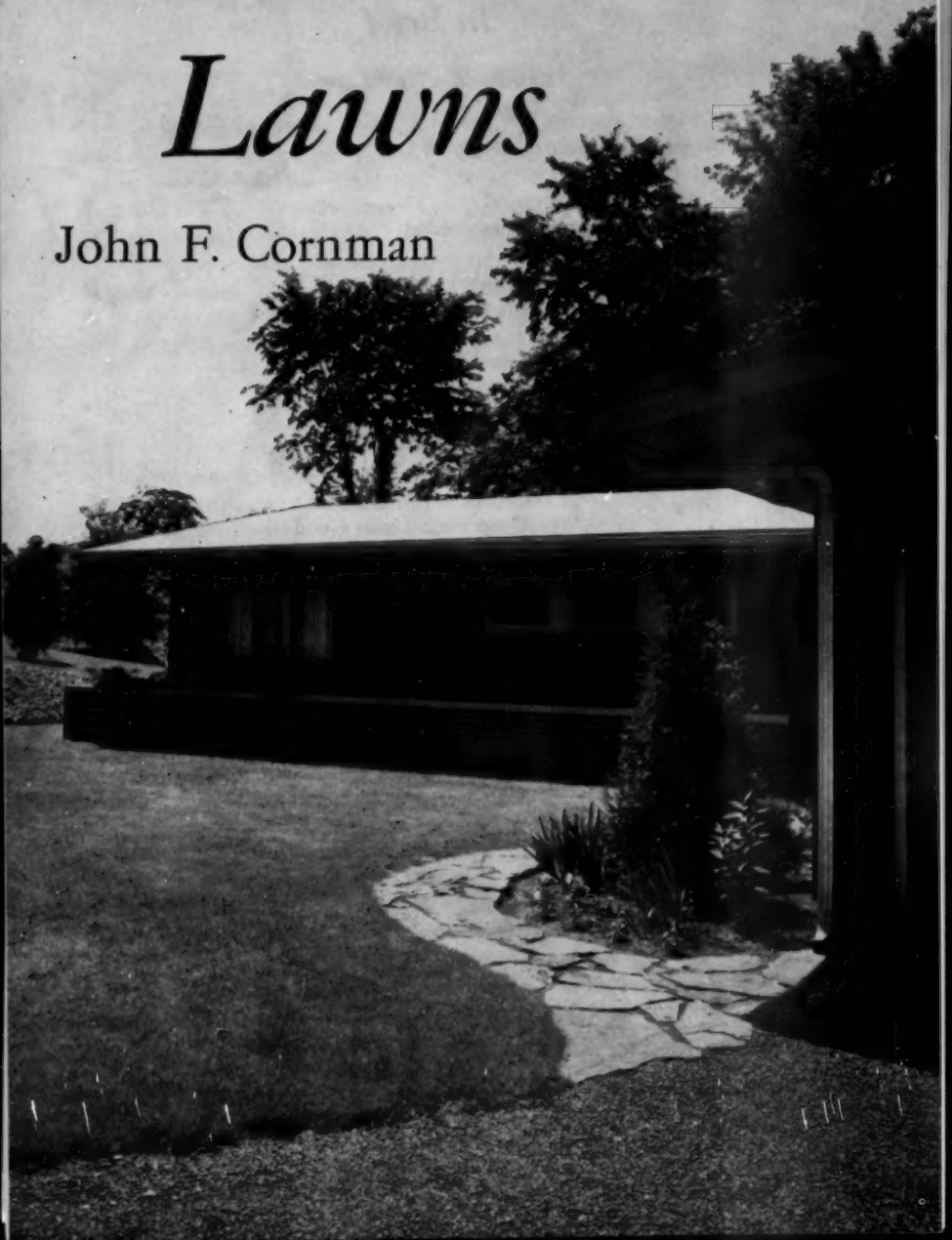


Home Lawns

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In Brief

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HOME LAWNS

EVERY home owner wants a good lawn to make his grounds more attractive and useful. Grass is a natural ground cover in much of New York, and sometimes only a little care is needed to have a good lawn. But soils are poor in most new suburbs. In southeastern New York, both the warmer climate and increasing numbers of natural enemies hinder

the grasses. There the home owner must use especially good judgment to help the grasses in their battle.

Many things are done to lawns. Some do more harm than good. Others sound scientific and provide good exercise, but waste time and money. While no one can guarantee perfect results everywhere, enough is known to make most lawns better than they are.

New Lawns

BEFORE you start your new lawn you need to read the next few pages and decide what you should do. The outline on the opposite page will also help.

Time of Planting

Time of seeding a new lawn is most important. The best time to sow grass seed in upstate New York is about September 1, and near New York City about two weeks later. Fall seedings are better than spring seedings because they have several more months of good growing weather to get started before crab grass and other summer troubles begin. Even late fall seedings, until the ground freezes, are a better risk than spring seedings in most areas.

Spring seedings made before mid-April are sometimes successful but are always more of a risk. Late spring and summer seedings usually are disappointments or complete failures (page 11).

If you prepare the seedbed several weeks before planting time, the loose soil settles enough to make the final grading easier. Also you can destroy some of the weeds that come up. But, if the best planting period arrives by the time you begin your work, go right ahead with the seeding.

Drainage

Unless excess water drains rapidly through the soil, the grass has a poor root system and weak growth. If your soil stays soggy

and wet after a heavy rain, you cannot grow a good lawn until you install artificial drainage. Detailed help on drainage problems is given in Cornell Extension Bulletin 875, *Farm Drainage*.

Grading

For a new home, the house foundation and the curb or sidewalk level are the fixed grade points. An older property has more places that cannot be changed. The problem in grading is to arrange the soil between these fixed points in gradual, pleasant slopes to lead water away from the house and off the property.

Avoid sudden steep slopes. They are unattractive and hard to keep covered with grass. Where much soil must be changed, move the topsoil into a pile and rearrange the subsoil. Then spread the topsoil evenly over the subsoil. In grading, be sure to allow for the gradual settling of loose soil. A 6-inch layer of loose soil settles to about 5 inches.

Soil

Topsoil

If you are building a new home, be sure to see that the topsoil is scraped into a pile and saved for even distribution after the builder has finished and the rough grading has been done. This important point is often overlooked, and only subsoil remains. With only subsoil to start with, try to find good topsoil. Plan to add at least 4

inches of topsoil even though it is expensive. That is the surest and often the most economical way to produce a good lawn.

The top 6 inches from a farm pasture or crop land is good topsoil. Do not accept river-bottom silt, or soil dug from a hill with a power shovel, or factory waste, regardless of how "rich" it looks.

If you live near a large city or in some other area where good topsoil is not available, work with what you have. Even poor soils, if well drained, often can produce a fairly good lawn with good soil preparation, adequate fertilization, and the right kind of grass seed at the proper season. Then if the lawn can be kept going for a few years with fertilizer added each spring and fall, the grass will produce enough organic matter and improve the soil gradually. The results will not be so good as with a really good topsoil, but the lawn will be as good as could be produced with much of the material sold as topsoil and it will be far less expensive.

Soil texture and organic matter

A very sandy soil is too "light" in texture. It is like a mass of tiny stones, with too few smaller bits of soil between the sand grains to hold water and fertilizer materials. Grass cannot do its best for lack of water and lack of nourishment. To improve a very sandy soil, work organic matter into it. An inch or

more of heavier soil helps, too, if it is mixed thoroughly with the top 4 inches of sand. A sandy soil is improved more if you add both organic matter and heavier soil than if you add either material alone.

A *clay soil* is a "heavy" soil. It is slippery and sticky when wet and shrinks and cracks open as it dries. Grass cannot do its best in a heavy clay, for there is not enough air in the soil for good root growth. Heavy traffic, where people walk or play, packs a clay soil even more tightly. Work organic matter into a heavy clay soil to improve it. Do not work sand into a clay soil; it will only pack harder than before.

If your soil needs organic matter, any one of several materials will do. Choose the one that is handiest and cheapest. For each 1,000 square feet of new lawn, use 3 bales of peat moss; or from 2 to 3 cubic yards of well-rotted manure or cultivated peat; or from 3 to 4 cubic yards of spent mushroom soil. Smaller amounts of organic matter are of little value.

Cover crops and green-manure crops are not practical for areas to be made into lawns. The amount of organic matter they add is relatively small and is not worth the cost, extra effort, and inconvenience.

Synthetic soil conditioners now on the market cannot be recommended for lawn soils until more is known about their usefulness. The best of them will improve

certain heavy clay soils. They all cost more than natural organic materials.

Liming and soil acidity

Some soils are too acid to grow good grass. Ground limestone will correct the trouble. The only way you can discover the lime needs of your soil is to have the soil tested. Directions for having a soil-acidity test made are given on page 32.

The results of soil-acidity tests are reported in terms of pH units.¹ The ordinary range for New York soils is from pH 4.5 (acid) to pH 7.8 (alkaline). Any normal soil with a pH value of 6.0 or above is all right for lawns as far as soil acidity is concerned. On soils with a pH value of less than 6.0, spread ground limestone at the rate of 50 pounds to each 1,000 square feet. This will be enough for one or for several years. For good results, spread the lime as evenly as you can. Do not apply more lime until another soil test shows the need.

Fertilizers

Seed sown on most soils that have not been fertilized either fails or produces a thin and weedy turf. Use 40 pounds of a 5-10-5 fertiliz-

¹In the pH scale, a value of 7.0 indicates a neutral soil, neither acid nor alkaline. Values less than 7.0 (as pH 6.5) indicate acidity (the smaller the number, the more acid or "sour" the soil), and pH values more than 7.0 (as pH 7.5) indicate alkalinity (the larger the number, the more alkaline or "sweet" the soil).

er or the equivalent² for each 1,000 square feet of new lawn for good results. Only on very rich soils, or where fertilizer has been applied recently, should less than this rate be used. At seeding time fertilizer is almost always needed, so chemical tests of lawn seedbeds are not necessary. Fertilization is so safe and economical that a good rule is to fertilize every new seedbed and to fertilize it well.

Kinds of Lawn Grasses

A common and most serious error in lawn making is the choice of the wrong kind of grass seed. If you have already decided to use a mixture of seeds and just want brief recommendations on how to choose a mixture, turn to page 8; but more study about the grasses and their use is worth the effort.

Grasses for permanent lawns

There is no perfect grass for northern lawns; but of the dozens that have been tried, four are far better and more durable than the others. These four basic lawn grasses are *Kentucky bluegrass*, *red fescue*, *rough bluegrass*, and *colonial bent*.

Kentucky bluegrass is the best grass for sunny places in good soil, and is the backbone of most mixtures for sunny lawns. Close clipping and overwatering injure

it. A leafspot disease may be serious during a cool moist spring season. *Kentucky bluegrass* turns brown during dry, hot summers but it recovers quickly. The Merion strain of *Kentucky bluegrass* is less troubled by leafspot than are the less expensive kinds.

Red-fescue strains are the best grasses for dry soil, either in sun or shade. They make a dark green, tough sod; the grass leaves are wiry and hard to cut with a dull mower. The red fescues turn brown in dry periods but recover quickly. Fescue turf dies promptly if watered too much. Named varieties of red fescue are Illahee, Trinity, Chewings, Penn State, and creeping red. The first two are a little better than the others, but any one of them is satisfactory for home lawns.

Rough bluegrass, or *trivialis bluegrass* (*Poa trivialis*), is a special-purpose grass for moist shade only. It seldom lasts long in dry sunny areas; seed sown there is wasted. Even in moist shade the bright green, soft leaves never make a really tough sod.

Bentgrasses make beautiful lawns that can stand close clipping, but they need more mowing, fertilizing, watering, and disease control than most home owners care to give. Hence the bent lawn is not discussed in this bulletin.

Colonial bents blend well with other grasses. They are useful in general seed mixtures to give a fine texture and to act as insurance,

²Other fertilizers serve as well (page 15).

should overwatering and close mowing drive out fescue and bluegrass. Highland colonial bent is less desirable than Astoria. Creeping bent (seaside) forms patches when mixed with other grasses and should be avoided.

Temporary grasses

Redtop, a coarse relative of the bents, and the ryegrasses, both the domestic and perennial kinds, are short-lived grasses that grow quickly. They encourage the home owner by a quick show of green color, but have little other value in a permanent lawn. A few ryegrass plants often live over for several years. They grow faster than the other grasses and need extra mowing for several seasons to keep the lawn neat. When more than 10 per cent of redtop or 15 per cent of ryegrass is used, these quick-growing kinds become "robber" plants that hinder the growth of permanent grasses. When used alone, ryegrass makes a quick, but temporary (one-season) lawn (page 11).

Pasture grasses and filler grasses

Timothy, orchard grass, sheep fescue, Canada bluegrass, meadow fescue, and the tall fescues (Alta and Kentucky 31) are sometimes useful for pastures, airports, and other rough areas. In a home lawn they will disgust the owner by their coarse, stubby, or clumpy growth. Unfortunately, they cost less per pound than good lawn

grasses, and find their way into many ready-made mixtures as "filler" grasses.

Clover

White clover is used in many lawn-seed mixtures. The chief advantages of clover are that it remains greener than most grasses during hot dry periods and may survive after mismanagement and neglect have killed the good lawn grasses. Clover is coarse in texture and forms patches that give the lawn a spotty appearance. It is soft and slippery, and the cause of "grass stain"; it does not compete with weeds as does good grass. In winter the clover patches are bare, and in early spring they are muddy spots.

Clover appears in many soils, although it was not planted. Where clover does not volunteer, it is difficult to grow even with good care.

If you want clover, buy a mixture that includes clover seed, or add it to any mixture of grass seed at the rate of 2 ounces to each 1,000 square feet. If you want to seed more clover in an established lawn, sprinkle the seed over the lawn in late winter when the ground is honeycombed by frost. Two ounces of clover seed to 1,000 square feet of lawn is enough. Mix the seed with sand or screened soil to make distribution easier.

Wild white clover, such as the Kent and New York strains, are better than the common White Dutch clover. New Zealand pas-

ture clover, sometimes misnamed wild white, is the least desirable.

Seed and Seeding

Separate seeds and seed mixtures

Any of the basic lawn grasses can be planted alone, with Kentucky bluegrass for sunny, good soils, the red fescues for dry soils, and rough bluegrass for moist shade. The usual seeding rates are 3 pounds of either of the bluegrasses or 6 pounds of red fescue to each 1,000 square feet. This is the most economical way to produce a lawn if your judgment is good. But if you pick the wrong grass for your soil and light conditions, or if you plant but one grass where several are needed, you lose. A mixture is a safer choice for most home owners.

Lawn mixtures are made on the "shotgun" principle; if a variety of seeds is used, something will have a chance to grow. At the same time, of course, some seed is wasted. A lawn of mixed grasses does not look so uniform as one grass alone; but when trouble strikes one of the grasses in a mixture, the damage does not look so serious.

Your greatest danger in buying a seed mixture is your own desire to save money. The only way a seedsman can meet demands for low price is to use cheap grasses. The price is tempting but good permanent lawns cannot be made from such material.

Choosing a ready-made seed mixture

The only important printing on a seed package is the label, required by law, that states the contents of the mixture. For each grass the percentage present is given (along with germination percentages, weed seeds, and other facts). To judge quality, add the percentages of Kentucky bluegrass, red fescues, rough bluegrass, and colonial bent. If this total of basic lawn grasses is 80 per cent or more, the mixture is a good one. This is the mixture to buy if it passes one other test.

For most sunny lawns with a normal moisture supply, Kentucky bluegrass should make up at least 55 per cent of the mixture. This is the usual "sunny lawn" in upstate areas. For dry soils, either in sun or shade, red fescues should total at least 65 per cent in the mixture. This is the mixture for dry, shaded lawns throughout the State and for most lawns, either in sun or shade, of Long Island and the New York City area. If the other basic grasses that fill out the 80 per cent minimum are kinds likely to grow for you, the mixture will be even better.

If you buy a mixture of the quality suggested here, it is quite unlikely that you will get seed that is of inferior quality so far as germination percentages, weed seed, and inert matter are concerned.

Remember to look for at least 80 per cent total basic lawn grasses, including at least 55 per cent Kentucky bluegrass or 65 per cent red fescue, depending on your own lawn situation.

Grass seed is not improved by treatment with hormone powders, so do not pay extra for "hormonized" seed.

Where to buy seed

Poor seed mixtures are much easier to find than good ones. You may find what you want right away, or you may need to hunt for a while by telephone, in person, or even by mail. It is well worth the effort.

The most likely place to find seeds of the basic lawn grasses and better mixtures is where seed selling is the major business. In the suburbs and rural areas, inquire also at landscape supply companies, at feed, grain, and fertilizer dealers, and at farmer's cooperatives. Occasionally local stores carry widely-advertised mixtures of good quality. Most hardware, grocery, and variety stores offer only the poorest mixtures. But the analysis label tells the story; good mixtures are where you find them.

Seedbed preparation

Finish all of the drainage, rough grading, topsoil, and final grading the area needs. You should then have a smooth, even expanse of soil without humps and hollows

and with no trash or large stones.

Spread whatever organic matter, lime, and fertilizer are needed and mix them thoroughly with the top 4 inches of soil. Even distribution is important. Spread organic materials with a shovel or fork. For fertilizer and lime, a wheeled fertilizer spreader does the best job but careful distribution by hand will do (in the manner suggested below for sowing seed). Machines with revolving metal hooks are good for soil mixing. Perhaps you can rent or borrow one. Lacking this, turn the soil several times with a spading fork or tractor-drawn tool.

It may be more convenient to rake the fertilizer into the surface of the loose seedbed than to mix it deeply. This will not harm the seed, and the grass will grow about as well.

Rake the seedbed again to produce a smooth surface. If you have a roller, make one trip over each part of the seedbed. This firms the seedbed and shows up small humps and hollows to be corrected. Rake the seedbed once more to ready it for seeding. Do not rake the soil so much that the surface is powdery. A mixture of soil granules and small clods is better.

Sowing seed

Sow seed evenly, or there will be an uneven pattern of grass and bare ground. A mechanical spreader does the best job of seed-

ing (or fertilizing or liming), but hand seeding is satisfactory if it is done carefully. To seed by hand, first divide your seed into two equal parts. If this is your first attempt to sow seed, mix each half of the seed with some sand or fine topsoil to give you more material to work with. When there is no wind, scatter one half evenly and carefully while walking back and forth in parallel lines. Scatter the other half in the same manner while walking in lines at right angles to the first.

After the seed is sown, rake the soil lightly. Use just the tips of the rake teeth and cover the seed about $\frac{1}{8}$ inch. Seed covered too deeply will be lost, so omit this raking unless you can do it carefully. Go over the area with a lawn roller to firm the soil about the seeds. If you cannot roll the seeding, no harm will be done; the seeds will merely germinate a little slower.

Care of the New Seeding

Mulches for new seedlings

A straw mulch is not necessary for most new seedlings but will be especially helpful on steep slopes, on late spring seedings, or on sandy soil. It will do more harm than good if it is not handled carefully. Shake out the straw thoroughly with a fork and then spread it about 1 inch thick over the new seeding. When you have finished, you should still be able

to see about half of the soil surface through the straw. Water by sprinkling the straw. The mulch slows up surface drying and breaks the force of rains and of watering. Watch the grass growth carefully. When it is about 1 inch high, lift off about half of the straw with a fork. About a week later, lift off whatever you can of the remainder without tearing up the new grass. Try to choose a cloudy or rainy period to remove the mulch, for the tender new grass may be injured by sudden exposure to hot, bright sunshine.

Watering a new seeding

Seed must be wet before it can grow. Dry seed in dry soil is safe from harm. Many birds may come, but the amount of seed they eat is seldom important. Rain usually falls often enough for good growth, but results are quicker and surer with artificial watering. The first sprinkling must be thorough but gentle, to avoid washing the soil away. Keep the seedbed moist until the grass is well started, or the entire planting may be lost. Water more cautiously and more deeply once the grass comes up. Keep the soil moist but not soaking wet.

If there was no ryegrass or red-top in your seed mixture, seedlings may not appear for ten days or more after the soil is thoroughly wet. Do not be alarmed. Your neighbor, with a poorer mixture, will get a quicker cover; but this

is mostly show, because no new lawn will stand traffic until it is well established. Your lawn will be better than his after a few months.

First mowing

For the first mowing, set the mower to cut at least $1\frac{1}{2}$ inches high. Mow as soon as the grass is tall enough to reach the mower blades. Be sure the mower is sharp and the grass is dry. If the soil is too moist, seedlings will be pulled up. Mow often enough so that no matted clippings are left to smother the new grass. Keep matted clippings and fallen leaves off the new seeding by careful sweeping with a lawn broom. After the second or third mowing, little or no watering should be required unless there is a week or more without rain.

Sodding

Sodding is the quickest and most expensive way to get an established lawn. Sodding may be the only answer for steep slopes or for spots where traffic ruins a seeding. Transplanted pasture is worthless. Some landscape firms grow good turf especially for sodding work. On home grounds, it

may be worthwhile to move good sod from some other part of the lawn where grass is easier to grow.

Lay sod in spring or early fall. Prepare the soil as though seed were to be planted. The best sod is about 1 inch thick and of uniform width. Commercial sod cutters have machines for this work. Hand tools will do, but the work is tiring. To lift your own sod, work when the soil is fairly moist. Lay a solid board, 1 foot or more wide, on the turf. Stand on the board (to hold it in place) and cut vertically through the sod along the edges. Remove the board and lift the sod by cutting under it with a sod lifter or a sharp, flat spade. Cut the strips into convenient lengths as you work, keeping edges and corners square.

Lay the cut sods on the prepared soil, tightly together, and with staggered joints, like bricks in a wall. Fill all cracks with screened soil. Soak the soil thoroughly. As soon as it is dry enough to walk on, roll or tamp the sod to smooth out small bumps and give good contact with the soil beneath. Water it every two or three days and the sod should be rooted fast in two weeks.

Temporary and Emergency Lawns

CHEAP grass seed is sometimes a sensible choice. If you move into a new house too late in

the spring to plant good grasses, the simplest thing to do is to wait for mid-August and then start a

permanent lawn. But if you must have a lawn right away, plant ryegrass. Or perhaps you have an old lawn where the best efforts with good grasses have failed because of heavy shade or too much traffic. If you must have a turf cover here, plant ryegrass.

Ryegrass costs less than low-quality seed mixtures and will do as well. Low price per pound is misleading in either case, because heavier plantings of these larger seeds are needed than with the permanent grasses. Domestic ryegrass, the cheapest and commonest ryegrass, is good for temporary lawns. Perennial ryegrass may last for several years. Where ryegrass is wanted for more than one season, perennial ryegrass is worth the extra cost. Either will do.

Before you start a temporary lawn, read how to start a permanent lawn. The more of these steps you can finish now, the better your summer lawn will be. But you may want to go right ahead with the temporary seeding now and wait until August for the soil-building work. Whichever you do, finally prepare a good seedbed and fertilize it well (page 3).

Then sow domestic ryegrass at the rate of 6 to 8 pounds to 1,000 square feet. Keep the seedbed moist and you should have turf in two weeks. If you mow as high as your machine can be set (usually about 2 inches) and water the grass when the weather is dry, you should have grass through the summer.

Turn the ryegrass under in mid-August and start a permanent lawn. Do not skimp any of the items needed for a successful planting. Do not reduce the fertilizer because of the earlier application.

For a permanent turf cover, a planting of permanent grasses is the cheapest in the long run. Where a permanent lawn cannot be developed, in spite of the best soil-building and seeding efforts, ryegrass can be made to serve. Merely use perennial ryegrass at the rate of 6 to 8 pounds to 1,000 square feet instead of permanent grasses. Mow it high, water whenever the weather is dry, and fertilize each spring and fall. Whenever dead patches appear, loosen the soil and sow more seed.

Regular Lawn Care

EVERY lawn, good or bad, needs to be mowed regularly. Fertilization and rolling are necessities for high-quality turf. Watering may or may not be desirable

on your particular lawn. These four operations, with particular emphasis on fertilization and mowing, are all that need concern you except for special circumstances.

Mowing

Close mowing ruins many lawns. Mow high and often should be the rule. Set your mower to cut at about 1½ inches and leave it that way throughout the year (page 11). Your lawn will look neat at this height and you will still be leaving enough top growth to produce food for a deep root system and a solid turf. Mow throughout the season, whenever there is ½ inch or so of growth to be cut. Keep on mowing as long as the grass continues to grow in the fall. Mow often enough so that the clippings will disappear by the next day. Leave the clippings where they fall, for they return nourishment to the soil. If, by chance, you delay mowing so long that bunches of clippings remain the day after cutting, rake these clippings up or spread them out so they will not smother the grass.

Choosing a mower

Two types of lawn mowers are widely available. The older reel-type mower has revolving knives that pinch the grass blades against a stationary bed-knife in a scissors action. This mower shears the grass blades cleanly when it is properly adjusted and leaves no brown or ragged tips. A reel-type mower is best adapted to relatively smooth areas that are mowed regularly.

Motorized rotary mowers depend upon the high speed whip-

ping action of a sharpened blade whirling in the air. They will handle taller grass on irregular areas and are more useful for rougher work, as at a summer cottage or on areas mowed only a few times a season. Unless the blade is very sharp a rotary mower tears the leaf tips, and the lawn may appear scorched or singed the day after mowing.

Some power-driven mowers are self-propelled, some are not. Electric powered models have fewer starting troubles but the electric cord may be a nuisance and restricts the area of operation. Gasoline engines are noisy when they run and frustrating when they do not, but their use does not depend upon a source of electricity.

Just because a power mower is easy to run do not run it when it is dull or out of adjustment. Do not ruin your light machine in work too heavy for it.

Setting the mower

All lawn mowers have two adjustments. The first of these is the adjustment of the bed-knife so that it just misses the revolving blades (reel). Leave this adjustment to a competent repair man, or make it yourself only after receiving the repair man's instructions.

The second adjustment, that for height of cut, is also important and is easier to make. To adjust the mower so that it will cut at the proper height, proceed as follows:

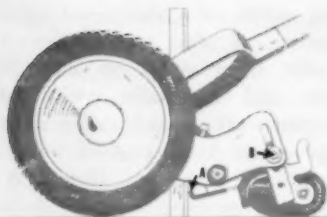


Figure 1. Lawnmower adjustment

1. Place the mower in cutting position on a sidewalk, floor, or other smooth surface.
2. Measure the height of cut from solid surface to the top of the bed-knife (figure 1, A).
3. Loosen the brackets that hold the roller (figure 1, B) and lower the roller until the bed-knife is $1\frac{1}{2}$ inches above the solid surface.
4. Tighten the roller brackets.
5. Check to see that the bed-knife is the same height at both ends. Readjust the roller if necessary.

Fertilizing

Materials

For convenience and adequate turf nutrition, use a complete fertilizer; that is, a fertilizer containing all three of the major fertilizer materials. The law requires that every package of fertilizer be labelled to show the guaranteed minimum percentages (or grade) of the three important fertilizer nutrients. For example, a 10-6-4 fertilizer contains at least 10 per cent nitrogen, 6 per cent phos-

phoric acid, and 4 per cent potash. Many grades of complete fertilizer are available.

Most complete fertilizers are composed of simple chemicals quickly absorbed by plants. These inorganic fertilizers are the least expensive and can be bought at any farm or garden store, but they require some care for safe application during the growing season. Natural organic fertilizer (such as activated sludge, processed tankage, and vegetable meals) release their nutrients somewhat more slowly. They are more expensive but they will not burn growing grass even if they are applied carelessly. Otherwise, the effect of the two types of fertilizer are similar, especially where clippings are left on the lawn.

Barnyard manure is not a good lawn fertilizer, for it is relatively low in nutrients and usually contains large numbers of weed seeds. Weed-free fertilizers are to be preferred, even when manure can be had without cost. Commercially dried manures are relatively expensive for the benefits received.

Liquid fertilizers may be more convenient to apply than dry fertilizers under certain circumstances. This is their only advantage over equivalent amounts of the more economical dry fertilizers.

Fertilizing established turf

If yours is an average lawn in good condition, fertilize it in early

fall. If your soil is poor or your lawn not thrifty, repeat the application in early spring. Even on good soils this second application will do no harm.

Rates to use

The fertilizer recommendations given here are in terms of pounds of 5-10-5 or its equivalent only because 5-10-5 is widely available at competitive prices and often is at hand for other purposes. Some other complete fertilizer may be more economical for you, depending upon your local market conditions; or perhaps you will choose a natural organic fertilizer or a combination organic-inorganic fertilizer because it is safer to apply to growing grass and stimulates the grass somewhat more gradually. So far as the benefit to the grass is concerned, *any of the many common grades of complete fertilizer will be satisfactory so long as you use it at the proper rate.*

To determine the proper rate for a single application of any fertilizer, consider only the first figure (nitrogen) of the grade you have chosen. Then find the rate for 1,000 square feet in table 1.

How to apply

Apply fertilizers evenly, or your lawn will have dark and light streaks. A mechanical spreader is best for this work. You may apply a natural organic fertilizer at any

Table 1. Amount of Fertilizer to Use

If the first figure of the grade is	For 1,000 square feet of area	
	of established lawn	of new seed-bed or lawn to be renovated
	Pounds	Pounds
4	25	50
5	20	40
6	17	33
7	14	28
8	12½	25
9	11	22
10	10	20

season without danger of burning your grass. Inorganic fertilizers will not burn if you spread them in early spring before growth starts. Inorganic fertilizers are entirely practical during the growing season, also, but take these precautions against burning: be especially careful about even distribution; spread fertilizer only when the grass is completely dry; and sprinkle the lawn thoroughly to wash the fertilizer from the grass blades to the ground.

Watering

A well-built lawn of bluegrass or fescue turns brown in a mid-summer drought but it recovers quickly when cooler, moister weather arrives. If your lawn will not survive an ordinary drought without watering, it probably needs rebuilding. You will avoid numerous problems and save money and effort, if you can learn to accept brown turf in occasional dry summers.

You can improve the appearance

of your lawn by proper watering, but you can ruin it if you are careless. Two or three waterings should keep your good lawn fairly green during the summer if you water when the soil begins to dry out but before the grass wilts and turns brown. To test for water needs, dig into the soil for 3 or 4 inches. If the soil is drying out, soak it to a depth of 5 or 6 inches. The time of day makes no difference to the grass, as long as the watering is timely and deep.

Frequent light sprinklings moisten only the surface of the soil, so the annual grasses and weeds benefit and the deeper rooted, basic grasses suffer. Soon there may be no Kentucky bluegrass or fescue left, and only the undependable annual grasses and weeds remain.

Rolling

As a regular maintenance practice, you need to roll your lawn only once a year. Roll your lawn in early spring with a roller just heavy enough to press the frost-heaved plants back into the soil. Do this before growth starts, when the soil is dry enough to crumble easily in your fingers. Then put the roller away for the season. More rolling will do no good and, if your soil is a heavy clay, it may be harmful.

Topdressing

If your lawn is uneven, make it smooth by topdressing with a

screened, weed-free topsoil or compost. Screened soil from the vegetable garden is usually satisfactory. Either in early fall or early spring broadcast this weed-free soil over the lawn to fill the depressions. Push the topdressing from the high spots to the low spots with the back of a rake, or fasten a rope to a metal door mat and drag it back and forth. Fill deep holes by lifting the sod and filling under it, or fill the deep holes with soil and sprinkle a little seed on the soil. Water the lawn to settle the loose soil and proceed with your regular maintenance program.

If your lawn is smooth enough for your purposes, you need not topdress it. Do not spread pure peat or "humus" on your lawn. These materials can do little or no good, and may do much harm.

Winter Protection

If you have a lawn of northern grasses, you do not need to worry about its freezing to death in the winter. Do not let the grass grow long in the late fall. This only adds to your maintenance work because of the long dead grass that must be removed the following spring.

Mulches of manure, straw, leaves, or other material do no good so far as protecting the grass is concerned and may be definitely harmful. They often smother and kill the grass and they provide ideal conditions for diseases in late winter and early spring.

Special Lawn Problems

Improving an Unsatisfactory Lawn

AN old, established lawn that has just been neglected is easy to repair. Kill the broad-leaved weeds with 2,4-D. Use plenty of fertilizer, add lime if needed, and then mow properly. In a season or two of fertilization and proper mowing, the lawn may be good enough for your needs. Old lawns in suburban and upstate New York often need no more than these easy, inexpensive steps plus continued good maintenance. If you are in doubt about the seriousness of your situation, save money and effort by trying this simple program first.

At the other extreme is the lawn that contains only scattered patches of grass, with many bare areas caused by crab grass, poor drainage, poor soil, the wrong kind of seed, insect attack, or similar basic difficulties. The only choice is to start over with a new lawn, correcting each error as you go along.

If your lawn contains at least 50 per cent of good grasses in a fairly uniform stand, a thorough renovation may save it. The steps necessary for this renovation are listed in order inside the front cover of this bulletin.

Lawns in the Shade

Shaded lawns are troublesome lawns. In reduced light even the

most tolerant grasses never make so good a sod as in the sun.

Sometimes shade alone is the chief difficulty, as near a building or under deep-rooted, high-branched trees. Here good soil preparation plus a shade-tolerant grass make a fairly good sod. This means that red fescue is the best grass to use if the soil is dry, or rough bluegrass if the soil is moist.

Under dense, shallow-rooted trees, the grass has a much harder time. The trees cut off the light and rob the soil of water and fertilizer. Of the common trees, Norway maple is the worst offender. Under such dense trees even your best efforts to get a lawn may fail.

If you want a lawn where there is a tree like the Norway maple, consider the possibilities. First, can the tree be removed? Any plant out of place is a weed; and the bigger the plant, the bigger the weed. If your tree serves you in some important way, keep it. If it does you no good, cut it down. Why be handicapped any longer by a mistake made long ago?

If you need your tree, or cannot remove it, give your new lawn every advantage. This means special care in all details of planting. Then plant red fescue alone or in a mixture. Fertilize it spring and fall, mow it at $1\frac{1}{2}$ inches or higher, and do not overwater it.

If your best efforts with red fescue fail and you still want a

lawn, try ryegrass both in spring and fall (page 11).

If both fescue and ryegrass fail, you must look for a substitute for grass. Myrtle is the best possibility for dry shade (page 18) but this also may fail. Then your choice is bitter, but simple: flagstone, brick, or gravel might look better than bare soil.

Steep Slopes

Avoid steep slopes if you possibly can. Turf on slopes suffers from drying when there is no rain and from washing when there is rain. Several good ways to landscape steep slopes without using grass are described in Cornell Extension Bulletin 749, *Landscape Steep Slopes*.

If you must have a steep slope and decide to use grass, be sure to round off the crest of the slope so that the mower will not scalp the grass. Where good red-fescue sod is available, sodding gives the best results. On very steep slopes, each sod may need fastening with a wooden peg. The sodding operation is described on page 11.

To plant a slope with seed, be careful not to skip any important point described for seeding on more level ground (page 3). Prepare a good seedbed with plenty of fertilizer, use a red-fescue mixture, and plant in early fall so that the grass will be established before the heat of the summer. A straw mulch or a burlap or cheese-

cloth covering may be especially helpful during the first few weeks.

Give turf on steep slopes the same care as other lawn areas but fertilize it more frequently and water it more thoroughly.

Ground Covers

Evergreen plants, like myrtle, English ivy, and Japanese spurge, are useful on home grounds in spots where grass is difficult to keep mowed. These ground covers do not stand traffic, but serve well close to foundations, under low-hanging tree branches, and on steep slopes. English ivy and Japanese spurge need more moisture than does myrtle. Of course, myrtle, too, will fail if the soil is too dry. Almost any nurseryman can supply these well-known plants.

Grass Substitutes

The author knows of no satisfactory lawn plantings of "self-tending" turf substitutes in New York State. For turf purposes here do not give serious consideration to *Dichondra*, pearlwort, turfing daisy, chamomile, sandwort or moss.

Southern Grasses

Florida vacationers may think of trying to establish St. Augustine grass or carpet grass in New York. Both of these will be killed during their first northern winter.

Warm-season Grasses

In midsummer good sod of the Zoysias (*Zoysia japonica* and *Z. matrella*) is superior to that of our northern grasses. It is more durable to summer traffic, more tolerant of low fertility, heat, drought, and close cutting, more resistant to summer weed invasion, and requires a bit less mowing. These advantages are especially noteworthy in Meyer Zoysia, a selection of *Z. japonica*. Accompanying disadvantages are that the Zoysias turn straw-brown in autumn and remain so until mid-spring, they are not resistant to traffic or weed invasion when dormant, they must (for all practical purposes) be started from plugs or sprigs of sod, they require several summers of good care to produce a solid sod, and they have not been consistently hardy in New York State. U-3 Bermuda grass, a somewhat hardier selection of the basic grass of the South, has many of the advantages of the Zoysias. In addition, it responds more vigorously to good summer conditions and forms a sod more promptly. The disadvantages of U-3 Bermuda grass are the same as those of the Zoysias, with lack of winter hardiness a special hazard.

Hobbyists may find trial plantings of Meyer Zoysia and U-3 Bermuda grass interesting, particularly at Long Island situations where turf is desired and used only in summer. Neither grass is likely to

satisfy the general desire for a trouble-free, care-free lawn in New York State.

Moss

Moss is an indication that growing conditions are not ideal for the turf grasses. Moss does not "crowd" the grasses, it merely occupies spaces where grass has not survived. Improve conditions for the grasses, and you will drive out the moss. Sometimes drainage is poor; correct poor drainage before you take other measures. Lime may be needed (test the soil), but lime without fertilizer is seldom helpful. Rake off the moss with an iron rake and then follow the renovation program suggested on page 17. Carry on with routine good-maintenance practices and the moss problem will gradually disappear.

Toadstools and Mushrooms

Toadstools and mushrooms live on dead organic matter. The surest cure is to dig out their source of food and to put in new soil. If there is a buried stump or root, this is simpler than if the organic matter is fine and is mixed throughout the soil. Chemical treatments are seldom helpful. Since the toadstools that appear in lawns are not poisonous, most home owners are satisfied to break them up with a rake or mower, and let it go at that.

Moles and Skunks

Moles raise ridges in the lawn as they burrow through the soil in search of grubs and worms to eat. Grubproof your lawn, if it needs it, and mole troubles will decrease. If moles persist, get a mole trap from your hardware store and set it properly and persistently. Poisoned baits are not effective.

Skunks may dig holes in your lawn in search of grubs and worms. Their activities often indicate the need for grubproofing. Once the grubs are killed, the skunks usually go elsewhere. More information about the control of moles, skunks, and other small animals is available in Cornell Extension Bulletin 729, *Control of Small Animals in Homes and Gardens*.

Weeds

In your lawn there is a constant battle between the grasses you want to grow there and the weeds you do not want. Lawns get weedy if conditions are more favorable for the weeds than for the grass. Grass will predominate if growing conditions are better for the grass than for the weeds. By altering the growing conditions, you can control by natural means the kinds of plants in a lawn. When you start a new lawn, try to prevent weeds from getting a foothold. If you remove weeds from an established lawn, stimulate the grass to better growth or weeds will merely

fill in the bare spaces again. Any sound weed-control program is based upon these principles.

Preventing weeds in new lawns

The greatest source of weed seeds in a new lawn is the soil itself. Almost any soil contains many more weed seeds than are introduced in the grass seed or are carried in. Scraping off the surface of the soil only exposes another layer of weed-infested ground and solves nothing. Where crab grass is not a particular problem, as in upstate areas, good soil preparation gives your new lawn a satisfactory head start on the weeds.

Planting at the proper season, with the right grasses, and adequate fertilization at seeding time are the most important items. In southeastern New York and on Long Island, fall planting is almost the only hope of preventing crab grass from taking over the lawn. If you plant in early fall, the grass can become dense and mature before most troublesome lawn weeds start growth late the following spring. Use plenty of fertilizer to speed the development of the grasses.

You can kill a few weeds if you let the seedbed lie unplanted for several weeks. Then the final raking before seeding the grass destroys the seedling weeds that have developed.

Do not try to prevent weeds by sowing an extra large amount of grass seed. A dense growth results

but the individual grass plants will be crowded and weak. Then diseases may kill large patches of grass, leaving the lawn wide open to weed invasion. To save money and to get better results, sow no more seed than you need and fertilize it well at seeding time so that each grass plant quickly becomes mature and sturdy.

The steps outlined above give results good enough to satisfy most persons in areas where crab grass is not a major pest. But if you are a garden hobbyist, determined to have a weedless lawn right from the start, you might try the calcium cyanamid treatment suggested on page 25.

Weed control in established lawns

If your lawn is weedy, the chances are that you established or maintained it so that the weeds were favored at the expense of the grass. A few kinds of weeds still resist our efforts to control them, but most of the common lawn weeds can be greatly reduced merely by improved lawn care. If your lawn has reasonably good drainage, you can probably produce a striking improvement in the weed situation merely by fertilizing and mowing properly. The more troublesome the weeds, the more important it is that proper maintenance practices be followed.

Sometimes weeds persist in spite of good maintenance. Then you will need to control them artificially. The time-honored method

of hand weeding is satisfactory for occasional weeds. For broadleaved weeds, a weed cane that drops a small amount of weed killer on each weed touched is much easier. Occasional patches of mat-forming weeds may be brushed with weed-killer solution, or dusted with inorganic fertilizer when the leaves are wet with dew.

The best control treatment for a general weed infestation on an area of any size is an overall treatment with a selective chemical that will kill the weeds and leave the grasses in good condition. The broadleaved weeds require different methods of control from those effective against such annual grasses as crab grass.

Controlling broadleaved weeds

By far the best material yet discovered to kill broad-leaved weeds without damaging the grass is the substance known as 2,4-D. A single application of 2,4-D eliminates dandelions, plantains, and many other larger weeds. Chickweed and other mat-forming weeds may require two or more applications at intervals of about one month. Clover may be damaged by 2,4-D, especially after spring treatments, but the clover usually recovers promptly. While 2,4-D will not control every broadleaved weed, it is the material to try first on any broadleaved weeds whether you know the names of your weeds or not.

2,4-D works slowly. In warm weather the reaction of 2,4-D can usually be seen within 24 hours. Weeds are not killed in that time but the stems and leaves curl and become crisp. Three or four weeks after treatment, the weeds dry up and nothing but a few shriveled leaves are left.

If your lawn is less than a year old or if there are newly seeded spots in your established lawn, wait until the new grass is at least 1 inch high before you apply 2,4-D. Bent grass may be damaged slightly by 2,4-D applications, but bluegrass and fescue and the other grasses ordinarily found in lawns are unharmed.

Some form of 2,4-D is available at any garden store. Liquid sprays and dry mixtures, with or without fertilizer, are available in many convenient sizes. Either a liquid or dry application will do a good job. Cost and convenience of application under your conditions are good guides for your choice.

Among the broadleaved weeds usually killed by a single 2,4-D treatment are dandelion, heal-all, buckhorn or narrowleaved plantain, broadleaved plantain, cinquefoil, ground ivy, black medic, moneywort, water pennywort, gosmore, and winter cress or yellow rocket. Purslane, hawkweed or paint brush, yarrow, and field sorrell or sheep sorrel often require 2 or more treatments. A few of the more common weeds require special attention.

Knotweed is a summer annual that thrives where turf is thin on compacted soil. It is very stubborn in summer; but when it is in the seedling stage, in April and May, you can kill it easily with a single 2,4-D treatment. A more vigorous lawn is the long-term answer to knotweed.

Wild garlic or onion is hard to kill during most of the year. Treat with 2,4-D in very early spring and follow with a second treatment early the following spring. The two treatments are needed to kill both the plants of the current season and those that will grow in the autumn from hard bulbets already in the soil.

Common and mouse-ear chickweed are often difficult. A 2,4-D treatment in early spring often succeeds, though a second or third treatment may also be needed. Potassium cyanate (crab-grass killer) at rates recommended on the package may give good control. If you have only scattered patches of mouse-ear, try dusting the patches with sulfate of ammonia when the grass is wet with dew. Water the spots a few hours later. Or try bruising occasional spots with your heel when you mow your lawn. The patches often get smaller and smaller under this rough treatment.

Speedwells (*Veronica*) of various species are becoming widespread pests in many lawn areas. *Veronica filiformis*, an escaped rock-garden plant, may engulf an

entire lawn in a season or two. To date there appears to be no sure answer to the Veronica problem. In experimental trials, 2,4-D has not performed well. In tests of common weed killers, best results so far have been from two weekly September applications of potassium cyanate (crab grass killer) at the rate of 5 ounces in 5 gallons of water to each 1,000 square feet of turf.

Many broadleaved weeds are killed with 2,4-D about as easily one season as another. Some weeds are more easily killed at specific seasons, as noted in the preceding paragraphs.

If most of your weeds are of the sort that can be killed at any time, autumn is an especially good season for treatment on the average home property. After the first frost, the leaves drop from your shrubs, annual flowers, and similar plants and you run no risk of injuring them by drifting spray. If crab grass is a serious problem in your lawn, do not make 2,4-D treatments in late spring, or crab grass will then move into the vacated spaces. If crab grass is not a special problem, and you are not particularly worried about the possibilities of spray drift, you may try 2,4-D successfully whenever the weeds are growing normally.

Dry preparations of 2,4-D are especially convenient if you have a fertilizer distributor available, and there is no likelihood of injury from drifting chemical. Of course,

you pay extra for this convenience.

If you apply 2,4-D as a spray, keep these two important precautions in mind. There is no good way to clean 2,4-D out of a sprayer, so once you use your sprayer for 2,4-D reserve it for that purpose alone. Do not use that sprayer at a later time on flowers or vegetables. Some landscape concerns rent sprayers for 2,4-D work. This might be a wise choice if you want to avoid the possibility of later damage to other plants. The second precaution in using liquid forms of 2,4-D is to work on a day when there is little wind. 2,4-D injures most broadleaved plants, leaving only grasses untouched. Drifting mist from the sprayer disfigures almost any broadleaved shrubs or garden plants. Some sensitive plants, such as roses, petunias, and beans, may be ruined. For small lawns, there are several practical substitutes for a sprayer. Small plastic nozzles are available for less than a dollar. These fit on an ordinary gallon jug. Refilling the jug continuously is tiresome but a small lawn can easily be done piece by piece over a period of time. Proportioners that fit on an ordinary garden hose are also satisfactory, though there is more chance for spray to drift onto other plants.

Crab Grass

Crab grass is an annual. Its seeds germinate in late spring and the plants grow rapidly, often crowd-

ing out much of the desirable grass in a few months. It sets seed in early fall; the plants are killed by the first frost, leaving bare spots in the lawn and a new supply of seeds in the soil. Any control program must be based upon these facts. You can prevent an infestation of crab grass in your new lawn or improve your old lawn, often in a few seasons, by the following steps:

1. Plant your new lawns in early fall; prepare the soil properly and select the right kind of seed for the situation. Note that crab-grass seed is rarely an impurity in even the cheapest and poorest seed mixtures. The plants come from the seed already present in the soil.

2. Fertilize the established lawn in early fall. If you fertilize in the spring, use an inorganic fertilizer before your lawn starts to grow and at about one-half the rate normally used in the fall. Late spring fertilization benefits the germinating crab grass, while fall fertilization gives the permanent grasses 5 or 6 months of good growing conditions before competition from the crab grass begins again.

3. Cut the grass at least $1\frac{1}{2}$ inches high. A large leaf area enables the permanent grasses to make strong growth. Crab grass cannot tolerate shade and many crab-grass seedlings die.

4. If your established lawn has crab-grass troubles, check the sod for grub injury, as described on

page 27. Beetle grubs damage lawns most seriously in late spring, just when crab grass is ready to start filling in the bare spots. If your lawn is infested with grubs, you cannot hope for lasting crab-grass control until you grubproof the soil.

5. If possible, prevent crab grass from seeding. This is easier said than done. Raking the seed stalks so that they can be mowed, collected, and discarded is a tiresome and time-consuming job, but it will reduce next year's seed supply. Several attachments to fit on the front of the lawn mower will pull the seed stalks up where they can be cut. These devices merely eliminate hand raking.

6. Hand-weed crab grass when the plants are small. Such weeding is sometimes practical on small areas of particular importance. If the crab-grass plants are large, pull them out with a "dandelion" rake just prior to fall reseeding. This "dandelion" rake has a head of sheet metal, with triangular teeth that hook under the crowns of the plants. Most garden supply houses carry such rakes in stock.

7. Water the lawn well or not at all.

The steps outlined will keep crab grass at a reasonable minimum in most lawns. If crab grass is a serious problem in your lawn and these easier methods are not adequate, you may feel that the expense and effort of a chemical treatment would be worthwhile.

Killing crab-grass seed in the soil

Apparently there is no chemical that can be sprayed on the surface of the soil that will kill the weed seeds and still permit your grass seed to grow. A method of killing weed seeds in new seedbeds by the use of calcium cyanamid has recently been developed. This fertilizer material works well if it is mixed into the new seedbed in mid-August at heavy rates (50 pounds to 1,000 square feet). Then after three weeks delay for the weed-killing action to take place and for the excess chemicals to disappear, you can plant the lawn seed. It is important to apply the calcium cyanamid when the soil is fairly moist and not to plant the new lawn until there have been several rains or irrigations. Calcium cyanamid is widely available at garden-supply stores along with detailed directions for using it in the preparation of new lawns.

Chemicals for crab-grass control in established lawns

Two common types of selective crab-grass killers are on the market. One of these contains phenyl mercury compounds (PMA) and the other potassium cyanate (PC). Either of these, when properly applied, gives good control of crab grass without permanent injury to good turf grasses.

Early in the season, June and early July, when the crab-grass plants are small, the phenyl mer-

cury compounds do their best work. These compounds are sold in liquid preparations and also in dry formulations. The liquid type is less expensive but is more troublesome to apply unless you have adequate spray equipment and are accustomed to using it. The dry formulations can be applied with any ordinary fertilizer spreader, with the expectation of good results. Phenyl mercury formulations discolor the lawn less than potassium cyanate. They are the better choice if you can start early enough, before the crab grass has crowded the lawn grasses.

Later in the season, near the end of July and in August, the potassium cyanate formulations are more effective. At this time of year the plants are large and have begun to take root at the joints. Apply potassium cyanate in a liquid spray. In most trials with dry applications of potassium cyanate, crab-grass control has not been nearly so good as with sprays. You can expect more turf discoloration from potassium cyanate than from phenyl mercuries, but proper applications will cause no discoloration that will not recover within a few weeks.

Both phenyl mercuries and potassium cyanate are offered for sale in many formulations. Whatever type of material and formulation you choose, you cannot expect good results unless you follow the manufacturer's directions precisely. With both types of crab-grass

killer, three or more applications at the correct intervals are ordinarily required. Complete success with crab-grass killing chemicals is not nearly so sure as with 2,4-D on broadleaved weeds, but good control ordinarily follows treatments that are made properly. Many failures are due to improper dilution, uneven distribution, and failure to repeat treatments.

The crab-grass killing chemicals do their best work and cause the least damage to the grass during moderately mild weather when there is a normal moisture supply in the soil. Do not expect success during periods of extreme drought.

These chemicals will help to eliminate crab grass for one season only. You must improve the conditions and correct your maintenance practices if you hope to keep crab grass out in the future.

Other weedy grasses

Goose grass or silver crab has a life cycle similar to that of ordinary crab grass. The cultural methods suggested for crab grass will help, as will weeding by hand. Selective chemicals are not effective against goose grass.

Orchard grass is a clumpy perennial persisting most often in rural lawns. Chemicals are not effective. With regular lawn maintenance and mowing, orchard grass declines gradually. If you are in a hurry, dig out the clumps, fill in the holes with soil, and reseed the spots.

Quack grass, a tough perennial, forms an open sod. Chemicals are not effective against quack grass. Hand digging is almost useless because of the underground stems that form new plants. Under good lawn care, quack grass usually disappears in a few seasons.

Insects and Earthworms

John G. Matthysse

What insect troubles to expect

In recent years the Japanese beetle and other turf pests have invaded many areas of New York State. Most lawns on *Long Island and in the lower Hudson Valley* will sooner or later have insect troubles. Although the Japanese beetle has generally declined in these areas in recent years, many lawns are injured by grubs of the oriental beetle, the asiatic garden beetle, and the masked chafer. Chinch bugs, ants, and other pests also cause local damage here.

The Japanese beetle¹ is the principal threat to *city and suburban lawns in eastern, central, and western New York*. In and around Albany, Troy, Saratoga Springs, Schenectady, Utica, Rome, Syracuse, Rochester, Elmira, Binghamton, Oneonta, and many smaller communities, you should look for Japanese-beetle grubs, and control

¹Details of the Japanese beetle problem are given in Cornell Extension Bulletin 770, *The Japanese Beetle*.

them before they seriously injure the lawn.

In *Wayne and Ontario Counties*, many lawns require protection against European chafer grubs. Rural lawns in these areas seldom require insect control measures.

Lawns in *northern New York* are seldom injured seriously by insects.

How to recognize insect damage

Insect-damaged lawns look browned, or thinned out, or ragged. Irregular patches of grass may even be killed. You can be sure it is insect damage only if you find the insects. *Grubs* chew off the grass roots. Seriously grub-damaged turf can be pulled up easily, and you can see the lack of roots. In late August or September and again in late May and June, the grubs can be found easily and quickly under the loose sod. Grubs are whitish wingless insects with a brown head and 3 pairs of legs near the head end, and usually lie curled like the letter "C". They may be from $\frac{1}{2}$ to 1 inch long. Grub injury usually is worst in sunny areas, and after the ground dries out in late spring or late summer. In an area where you suspect grub damage, dig a square foot sample of sod to a depth of 3 inches. Pick apart the sod over a piece of cardboard, and examine the soil carefully. (figure 2). If there are more than 5 grubs under a square foot, treat the soil immediately.

Sod webworms, *cutworms*, and *chinch bugs* feed on the stems and leaves of the grass, not on the roots as do grubs. Of these pests, only chinch bugs are commonly injurious in New York State. Chinch bugs cause yellowing or browning of the grass, usually in patches that gradually enlarge. Damage is most likely to occur in August. Chinch bugs are worst in thick turf, particularly in bent grasses. Examine the grass closely at ground level and you can find the tiny bugs. Some are red in color, but others dark, about $\frac{1}{8}$ inch long. Flood a small area with water and you will see these tiny bugs struggling to the water surface.

Ants and *earthworms* are not actually damaging to the grass itself, but the mounds thrown up can spoil the appearance of a good lawn.

Controlling lawn pests

Chlordane is the most generally useful insecticide for lawns. It



Figure 2. Grubs under damaged turf

kills all common grubs, as well as chinch bugs and ants. The amounts to use on each 1,000 square feet of lawn area are given in table 2. Use only one treatment. Choose whatever material is most convenient for you.

A single application of chlordane at the grub-proofing dosage is effective for at least five years. Do not grub-proof more than once in five years.

Other insecticides known to be effective include DDT (10 ounces per 1,000 square feet for grubs) and dieldrin (1.2 ounces per 1,000 square feet for grubs). DDT is not effective against the native white grub. Aldrin (0.8 ounce per 1,000 square feet) is effective against chinch bugs and ants.

The ultimate control of the Japanese beetle can be greatly aided by applying milky disease spore powder to low-value lawn areas. A community effort in applying milky-disease spore powder to back lawns, school and church grounds, parks, and the like is highly desirable. Do *not* depend on milky disease to protect your valuable front lawn. It is too slow in action and kills only Japanese-beetle grubs. Do *not* apply insecticide and milky-disease spore powder to the same lawn area.

How to apply insecticides

The easiest way to grub-proof a lawn is to use granulated insecticides in a fertilizer spreader. Two forms are available: one on a mineral granule that spreads about

Table 2. Amounts of Insecticides to Use

How applied	Insecticide to buy	Amount to use per 1,000 square feet
Grubs		
Wet spray	75%* chlordane emulsifiable solution	4 liquid ounces in 20 gallons water
Wet spray	40% chlordane wettable powder	10 ounces in 20 gallons water
Dry dust	5% chlordane granulated	5 pounds mixed with 5 pounds of activated sludge fertilizer
Granulated	5% chlordane dust	5 pounds
Granulated	2% chlordane granulated	10 pounds
For Chinch Bugs, Sod Webworms, Cutworms, Ants		
Wet spray	75% chlordane emulsifiable solution	2 liquid ounces in 20 gallons water
Wet spray	40% chlordane wettable powder	5 ounces in 20 gallons water
Dry dust	5% chlordane dust	2½ pounds

*45% chlordane emulsifiable solution may be used, at double the dosage.

like fertilizer; and another on tobacco waste, which is lighter and bulkier than fertilizer. For the commoner types of spreaders available, the mineral granules require an aperture less than one-fourth open; and for tobacco waste, a little more than half open. No exact recommendation for spreading can be given. You must adjust the spreader by weighing the amount run out over a known area of ground. Put in a weighed amount of granulated insecticide, spread over 100 square feet, and weigh what is left in the spreader. The difference between the two weighings multiplied by 10 gives the rate per 1,000 square feet. Of course, the walking speed should not be changed once the adjustment is completed. Granulated insecticides have not been thoroughly tested against chinch bugs, sod webworms, or cutworms.

Grub-proofing may also be done by wet spraying. Spraying is the most satisfactory way to control chinch bugs, sod webworms, cutworms, and ants. Use 20 gallons of water to 1,000 square feet of lawn. Mix the insecticide thoroughly with the water, and then spray the lawn thoroughly and evenly.

Hose-on type sprayers (to attach to your garden hose) may also be used. Follow manufacturer's directions.

Dusting is a poor method of lawn grub-proofing. Dusting is, however, a very good way to treat smaller spots damaged by chinch

bugs, sod webworms, cutworms, or ants. Use 5 per cent chlordane dust. Dust lightly but thoroughly until you have used the right amount of dust. To be sure of a thorough job, measure the area, weigh out the necessary amount of dust, and use it all up. For occasional ant hills, place a teaspoon of 5 per cent chlordane dust in and around each ant hill.

The best way to get large lawn areas treated is to hire a commercial custom sprayer or arborist to do the job. Large power spray equipment is necessary for treating large turf areas.

Insecticides recommended for turf-insect control can be safely mixed with fertilizers or with 2, 4-D weed killers. Fertilizers are good materials for mixing with insecticides for dry application by fertilizer spreader. Do not use hydrated lime with insecticides; use ground limestone instead.

Precautions

Be careful to keep packages of insecticides where children and pets cannot get at them. *Follow precautions on the label.* Do not allow children and pets to walk or play on recently treated grass; water-in all treatments with the garden hose.

Diseases

If definite dead patches appear in your lawn during the growing season, the chances are that the dead spots are *not* caused by a

disease. More frequent causes of definite dead spots in mixed turf are chemical and fertilizer burns, spilled oil, female dogs, and dry spots over buried rocks or gravel pockets. On bent lawns and golf-course putting greens, several common diseases may kill grass in a spot-like pattern, but these diseases are rarely troublesome on ordinary lawns.

Diseases that attack lawn grasses can be divided into three general groups; (1) seedlings diseases, (2) bent-grass diseases, and (3) diseases of ordinary lawns.

Damping-off and spot blight, the two most common diseases of tender seedling turf, are favored by warm weather and moisture. You can do much to prevent these diseases if you avoid overwatering seedling turf and if you produce turf of mature grass plants before warm weather begins.

Large brownpatch, dollarspot, and snowmold are constant threats to bent-grass putting greens and bent lawns. Of these, only snowmold may be conspicuous on ordinary home lawns. The snowmold fungi show their effects in late winter and early spring and cause roughly circular spots of matted silvery-gray turf. On home lawns, the spotting appears most commonly in shaded areas, where moisture remains for a long period in late winter and early spring. Since ordinary lawns usually recover promptly, most home owners are

satisfied to accept occasional discoloration rather than take the trouble to apply preventive chemical treatments each autumn.

Three diseases cause serious damage to ordinary lawns: bluegrass leafspot, melting out, and curvularia.

Bluegrass leafspot

From mid-April to late May, especially during periods of wet weather, leafspot may attack bluegrass anywhere in New York. The grass blades show purple spots that enlarge and turn straw-colored, with purple borders. A spot may girdle the leaf, kill the tip, and destroy the entire blade. If the attack is severe, the bluegrass turf becomes thin and weak, leaving it wide open to invasion by summer weeds. The spores of this fungus can persist for a long time and the disease may reappear from year to year in the same area. Merion bluegrass, a selected strain of Kentucky bluegrass, is troubled by leafspot much less than is ordinary Kentucky bluegrass. High mowing and adequate fertilization decrease the damage from leafspot.

Melting-out

The season for Melting-out (*Helminthosporium*) is through the spring until hot weather comes. The diseased areas are smoky blue in color at first, later become yellow, and finally turn

brown when the grass plants are killed. The injured areas are irregular, without particular pattern. Both bluegrass and fescue, as well as bent, may be damaged.

Curvularia

The fungus *Curvularia* produces a disease sometimes called *fading-out* because of its indefinite symptoms. This disease appears most often in the hot summer months, following the leafspot and melting-out seasons. At first the lawn appears to be drying out, even when there is no lack of moisture. The turf turns pale green, then yellow, and may eventually die. The affected areas are without definite outline, and frequently bright green islands of healthy grass remain in the injured areas.

Control

The various phenyl mercury compounds, in either liquid or dry applications, are reported to give protection against leafspot, meltingout, and *Curvularia*. So is cyclohexamide, a new antibiotic sold under the trade name of Actidione. Either type of material, along with directions for its use, is available from garden-supply stores. Grasses can be protected partially or completely from turf diseases if the grass blades are covered with one of these materials either before the disease starts or in its very early stages.

To treat or not to treat

Whether to treat your lawn for disease control is a problem you must decide for yourself. There are several complications. First, you cannot be sure in advance that a disease will strike your lawn. Perhaps only once in several or many years will weather conditions be just right for a damaging attack to develop. Second, the diseases of ordinary lawns, especially melting-out and *Curvularia*, are difficult for even an experienced person to identify in the early stages, just when treatments should be applied to be of value.

The chances are that the first time your lawn is troubled by one of these diseases the major damage will be done before you know what is causing the trouble. Once the grasses are dead, chemicals will not bring them back to life. Patch or reseed the dead areas; be alert for early symptoms next year.

If you know from your neighbor or from your County Agricultural Agent that one of these diseases is commonly destructive in your area, you can, of course, apply a series of preventive treatments each year. If you live in southeastern New York or on Long Island and are working for a top-quality lawn, a series of phenyl mercury treatments each year may seem reasonable as protection against both crab grass and the common turf diseases,

Directions for Sampling Soils

TO HAVE your lawn soil tested for lime needs, proceed as follows: With a trowel or stout knife dig samples to a 2-inch depth from six or more parts of your lawn area. Mix these samples together thoroughly. Take or send 1 or 2 cupfuls of this mixture to your County Agricultural Agent (usual-

ly at the county seat) and ask for a soil acidity test. If you live in one of the boroughs of New York City (where there are no County Agricultural Agents), mail your sample to the Department of Floriculture and Ornamental Horticulture, Cornell University, Ithaca, New York.

If You Need More Help

MOST of the hundreds of questions asked each year about lawns have been answered in this bulletin. If you follow these suggestions carefully, you should have good results, weather permitting. If you have a special problem not covered here, write to the Department of Floriculture, Cornell University, Ithaca, New York. Be sure

to include a brief description of your lawn area, an outline of any treatments given it during the past year, and an account of how your lawn has changed to make you dissatisfied. Your description will be of much more value than a soil sample alone. The more detailed you are, the more specific will be the recommendations.

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